CLAIMS

What is claimed is:

1. A method of characterizing an environment, comprising:

receiving uplink signals from a plurality of antenna array elements;

estimating uplink spatial signatures from the received uplink signals; and

characterizing the environment based on the estimated uplink spatial signatures.

2. The method of claim 1 wherein estimating uplink spatial signatures comprises:

estimating an uplink spatial signature of the received uplink signals; and

calculating a geometric uplink spatial signature of the received uplink signals.

3. The method of claim 2 wherein characterizing the environment based on the estimated uplink spatial signatures comprises:

finding a correlation between the estimated uplink spatial signature and the geometric uplink spatial signature; and

selecting a low clutter environment estimation if the correlation between the estimated uplink spatial signature and the geometric uplink spatial signature is greater than a low clutter threshold.

4. The method of claim 2 wherein calculating the geometric uplink spatial signature comprises:

estimating a dominant angle of arrival of the uplink signals received by the plurality of antenna array elements;

calculating an uplink spatial signature of the received uplink signals using the estimated dominant angle of arrival.

5. The method of claim 2 wherein finding the correlation between the estimated uplink spatial signature and the geometric uplink spatial signature comprises calculating a normalized dot product of the estimated uplink spatial signature and the geometric uplink spatial signature.

6. The method of claim 2 wherein estimating the uplink spatial signature of the received uplink signals comprises calculating a correlation vector between the uplink signals received by the plurality of antenna array elements and a reference signal.

7. A method of characterizing an environment, comprising:

receiving uplink signals from a plurality of antenna array elements;

calculating pairwise correlations of the uplink signals received by the plurality of antenna array elements;

calculating an average of absolute values of said pairwise correlations of the uplink signals received by the plurality of antenna array elements; and

selecting a high clutter environment estimation if the average of the absolute values of said pairwise correlations of the uplink signals received by the plurality of antenna array elements is less than a high clutter threshold.

8. The method of claim 7 wherein calculating said pairwise correlations of the uplink signals received by the plurality of antenna array elements comprises calculating a normalized dot product for said pairwise correlations of the uplink signals received by the plurality of antenna array elements.

9. A method of characterizing an environment, comprising:

receiving uplink signals from a plurality of antenna array elements;

calculating a correlation matrix from the uplink signals received by the plurality of antenna array elements;

estimating a source order from the correlation matrix; and

selecting a high interference environment estimation if the estimated source order is greater than a high interference threshold.

10. The method of claim 9 wherein estimating the source order in response to the correlation matrix comprises:

calculating Eigen values of the correlation matrix; and

performing a sequential hypothesis technique on the Eigen values to estimate the source order.

11. The method of claim 9 wherein estimating the source order in response to the correlation matrix comprises:

calculating Eigen values of the correlation matrix; and

performing an Akaike Information Criteria technique on the Eigen values to estimate the source order.

12. The method of claim 9 wherein estimating the source order in response to the correlation matrix comprises:

calculating Eigen values of the correlation matrix; and

performing a minimum descriptive length technique on the Eigen values to estimate the source order.

13. A method of characterizing an environment, comprising:

receiving uplink signals from a plurality of antenna array elements;

calculating a signal to noise ratio in response to the uplink signals received from the plurality of antenna array elements;

measuring a bit error rate (BER) in response the uplink signals received from the plurality of antenna array elements;

determining an expected BER in response to the signal to noise ratio; and

selecting a high interference environment estimation if the measured BER is a BER threshold amount greater than the expected BER.

14. The method of claim 13 wherein calculating the signal to noise ratio in response to the uplink signals received from the plurality of antenna array elements comprises:

measuring a received signal strength indication (RSSI) in response to the uplink signals received from the plurality of antenna array elements; and

measuring noise included in the uplink signals received from the plurality of antenna array elements.

15. The method of claim 14 further comprising selecting the high interference environment estimation if the measured BER is a BER threshold amount greater than the expected BER and the RSSI is greater than a RSSI threshold value.

16. An apparatus, comprising:

a plurality of antenna elements;

a receiver coupled to receive uplink signals from the plurality of antenna elements; and

a signal processor coupled to receive the uplink signals to select an estimation of an environment responsive to the uplink signals received from the plurality of antenna elements.

17. The apparatus of claim 16 further comprising a memory coupled to the receive and the signal processor to store uplink signals received from the plurality of antenna elements.

18. The apparatus of claim 16 wherein the signal processor is coupled to select a low clutter environment estimation if a correlation between an estimated uplink spatial signature and a geometric uplink spatial signature is greater than a low clutter estimation threshold.

19. The apparatus of claim 18 wherein the signal processor is coupled to calculate the geometric uplink spatial signature responsive to a dominant angle of arrival estimated by the signal processor responsive to the uplink signals received from the plurality of antenna elements.

20. The apparatus of claim 16 wherein the signal processor is coupled to select a high clutter environment estimation if an average of absolute values of pairwise correlations of the uplink signals received from the plurality of antenna elements is less than a high clutter estimation threshold.

21. The apparatus of claim 20 wherein the signal processor is coupled to calculate said pairwise correlations of the uplink signals received from the plurality of antenna elements by calculating normalized dot products for pairs of the antenna elements.

22. The apparatus of claim 16 wherein the signal processor is coupled to select a high interference environment estimation if an estimated source order responsive to the uplink signals received from the plurality of antenna elements is greater than a high interference estimation threshold.

23. The apparatus of claim 16 wherein the signal processor is coupled to select a high interference environment estimation if a measured bit error rate (BER) in the uplink signals received from the plurality of antenna elements is greater than an expected BER and a received signal strength indication (RSSI) of the uplink signals is greater than an RSSI threshold value.

24. The apparatus of claim 23 wherein the signal processor is coupled to determine the expected BER in response to a signal to noise ratio of the uplink signals received from the plurality of antenna elements.

25. A machine-readable medium having stored thereon instructions, which when executed cause:

receiving uplink signals from a plurality of antenna array elements;

storing the uplink signals received from the plurality of antenna array elements;

selecting an estimation of an environment responsive to the uplink signals received from the plurality of antenna elements.

26. The machine-readable medium of claim 25 wherein selecting the estimation of the environment comprises:

estimating an uplink spatial signature responsive to the uplink signals received from the plurality of antenna array elements;

estimating a dominant angle of arrival responsive to the uplink signals received from the plurality of antenna array elements;

calculating a geometric uplink spatial signature responsive to the uplink signals received from the plurality of antenna array elements and the estimated dominant angle of arrival;

finding a correlation between the estimated uplink spatial signature and the geometric spatial signature; and

selecting a low clutter environment estimation if the correlation between the estimated uplink spatial signature and the geometric spatial signature is greater than a low clutter threshold.

27. The machine-readable medium of claim 26 wherein finding the correlation between the estimated uplink spatial signature and the geometric spatial signature comprises calculating a normalized dot product between the estimated uplink spatial signature and the geometric spatial signature.

28. The machine-readable medium of claim 25 wherein selecting the estimation of the environment comprises:

calculating pairwise correlations of the uplink signals received from the plurality of antenna array elements;

calculating an average of absolute values of said pairwise correlations of the uplink signals received by the plurality of antenna array elements; and

selecting a high clutter environment estimation if the average of the absolute values of said pairwise correlations of the uplink signals received by the plurality of antenna array elements is less than a high clutter threshold.

29. The machine-readable medium of claim 28 wherein calculating pairwise correlations of the uplink signals received from the plurality of antenna array elements comprises calculating a normalized dot product for said pairwise correlations of the uplink signals received from the plurality of antenna array elements.

30. The machine-readable medium of claim 25 wherein selecting the estimation of the environment comprises:

calculating a correlation matrix in response to the uplink signals received from the plurality of antenna array elements;

estimating a source order in response to the correlation matrix; and

selecting a high interference environment estimation if the source order is greater than a high interference threshold.

31. The machine-readable medium of claim 30 wherein estimating the source order in response to the correlation matrix comprises calculating Eigen values of the correlation matrix and estimating the source order in response to the calculated Eigen values.

32. The machine-readable medium of claim 25 wherein selecting the estimation of the environment comprises:

measuring a bit error rate (BER) in response to the uplink signals received from the plurality of antenna array elements;

determining an expected BER in response to the uplink signals received from the plurality of antenna array elements;

selecting a high interference environment estimation if the measured BER is a BER threshold amount greater than the expected BER and a received signal strength indication (RSSI) of the uplink signals is greater than an RSSI threshold value.

33. The machine-readable medium of claim 32 wherein determining an expected BER in response to the uplink signals received from the plurality of antenna array elements comprises measuring a signal to noise ratio of the uplink signals received from the plurality of antenna array elements, the expected BER related to the signal to noise ratio.

34. A method of characterizing an environment, comprising:

receiving uplink signals from a plurality of antenna array elements; and

characterizing the environment based on the received uplink signals.

35. The method of claim 34 wherein characterizing the environment based on the received uplink signals comprises:

estimating an uplink spatial signature from the received uplink signals;

calculating a geometric uplink spatial signature from the received uplink signals;

finding a correlation between the estimated uplink spatial signature and the geometric uplink spatial signature; and

selecting a low clutter environment if the correlation between the estimated uplink spatial signature and the geometric uplink spatial signature is greater than a low clutter threshold.

36. The method of claim 34 wherein characterizing the environment based on the received uplink signals comprises:

calculating pairwise correlations of the uplink signals;

calculating an average of absolute values of said pairwise correlations; and

selecting a high clutter environment estimation if the average of the absolute values of said pairwise correlations is less than a high clutter threshold.

37. The method of claim 34 wherein characterizing the environment based on the received uplink signals comprises:

calculating a correlation matrix from the uplink signals;

estimating a source order from the correlation matrix; and

selecting a high interference environment estimation if the estimated source order is greater than a high interference threshold.

38. The method of claim 34 wherein characterizing the environment based on the received uplink signals comprises:

calculating a signal to noise ratio in response to the uplink signals;

measuring a bit error rate (BER) in response the uplink signals;

determining an expected BER in response to the signal to noise ratio; and

selecting a high interference environment estimation if the measured BER is a BER threshold amount greater than the expected BER and a received signal strength indication (RSSI) of the uplink signals is greater than an RSSI threshold value.